

Experimenting with the laminate, the inventor has found that a problem can arise due to the different thermal expansion rates of lower polyester layer 30, adhesive 40 and upper glass layer 20. Polyester layer 30 and adhesive 40 have similar expansion rates, but glass layer 20 and polyester layer 30 have very different expansion rates, polyester layer 30 having a higher expansion rate than glass layer 20.

When applied to a touch screen display 50 these expansion rates can create false touches or shorts 35 between touch screen laminate 10 and the backing display layer 70. This happens when touch screen display 50 is exposed to different temperature extremes. When it is cold, polyester layer 30 will shrink.

Touch screen membranes are typically mounted to a backing surface 70 using a pressure sensitive adhesive 60 along the periphery of the outer touch screen layer. This adhesive 60 has a bubble-gum like texture and is not elastic.

When polyester layer 30 shrinks when exposed to cold, pressure sensitive adhesive 60 stretches to allow the polyester layer 30 to contract. The touch screen display 50 will still function at this point. However, when touch screen display 50 is warmed up again, polyester layer 30 will expand, and since pressure sensitive adhesive 60 is not elastic, the polyester will tend to rumple between pressure sensitive adhesive 60 and spacer dots 80 used to maintain a normal spacing between the conductive coating applied to the lower edge surface of layer 30 and the upper surface of backing surface 70, as illustrated by false short 35. While not illustrated, one skilled in the art will realize that spacer dots 80 can be affixed to either polyester layer 30 or backing surface 70.

Glass layer 20 tends to keep the remainder of polyester layer 30 flat, and thus the expansion will be reflected completely or at least primarily along the edge of glass layer 20. In the prior art, the completely polymer touch screen would distribute this expansion evenly. However, due to adhesive 40 and glass layer 20, this does not occur in laminate 10, and the problem of false touches is increased in those cases in which the screens are exposed to temperature extremes.

Reference is now made to Figure 3. One possible solution to the above problem is to expand glass layer 20 to the edges of polyester layer 30. This would ensure that polyester layer 30 remains flat against glass layer 20, to limit or prevent false touches.

A possible problem with this solution is that adhesive 40 may fail due to repeated expansion or contraction of polyester layer 30 without the outer expansion area shown in Figure 2. In the solution of Figure 3, adhesive layer 40 absorbs all of the stress induced by the differing expansion rates of the glass and polyester. Eventually it is envisioned that optical adhesive 40 could fail and separation of glass layer 20 and polyester layer 30 could occur.

A preferred solution to the above problem is illustrated in Figure 4. In this embodiment, [a] polyester layer 30 is larger than glass layer 20, thus still permitting ease of manufacture. It also allows optical adhesive 40 to be built up about the edges of glass layer 20 to better hold glass layer 20 to polyester layer 30.

In order to overcome the false touch problem, an elastic tensioner 110 is added to touch screen display 50 to circumscribe adhesive 60. Further, an active area insulator 120 is added between polyester layer 30 and elastic tensioner 110.

Elastic tensioner 110 preferably comprises silicon rubber. In operation, elastic tensioner 110 creates an elastic force that normally biases or stretches polyester layer 30 outwards. Therefore, if display 50 becomes very cold, polyester layer 50 will shrink, pulling pressure sensitive adhesive 60 inwards, along with elastic tensioner 110. When the display 50 is later warmed, elastic tensioner 110 pulls polyester layer 30 back to its original configuration, reducing the possibility of rumples, and thus false touches.

Area insulator 120 further aids in preventing a false short 35 by providing a non-conductive layer in the area most likely to make false contact. Area insulator 120 comprises an ultraviolet ink film printed onto the lower surface of the polyester layer 30 along its outer edges. As one skilled in the art will appreciate, the thickness of area insulator 120 in Figure 4 has been exaggerated for illustrative purposes, and in practice area insulator 120 adds no significant spacing between polyester layer 30 and backing surface 70.

Area insulator 120 reduces the chances of electrical contact between polyester layer 30 and backing surface 70. It has been found that pressure sensitive adhesive 60 is insufficient for this purpose.

Area insulator 120 bonds aggressively, perhaps covalently, to polyester layer 30, and thus pressure sensitive adhesive 60 and elastic tensioner 110 are essentially bonded to polyester layer 30 itself.

- 5 One skilled in the art will realize that the ~~embodiments~~ embodiments illustrated in Figures 2 and 3 will typically also have an area insulator layer 120 between polyester layer 30 and pressure sensitive adhesive 60.

- 10 When combined, the above configuration provides a resistive touch screen with an outer glass layer, overcoming the difficulties of the prior art. The above configuration further provides a means to compensate for the different thermal expansion rates of the different materials of the laminate.

- 15 Although the present invention has been described in detail with regard to the preferred embodiment thereof, one skilled in the art will easily realize that other versions are possible, and that the invention is only intended to be limited in scope by the following claims.